DIRECT CONNECTED METERS

REPAIR AND TESTING OF SINGLE PHASE METERS RETURNED FROM SERVICE

1. Inspect meter case externally for signs of damage or burning, etc. or presence of paint.

2. Check that terminals are correct size, i.e. 10/40 meters may have ¼" or 3/8" terminals but all other meters are to have 3/8" terminals. All terminal screws must be OBA and terminals must be free of corrosion, burning, or other damage.

3. Remove cover and inspect for loose glass, corrosion on securing screws and sealing lugs. Inspect gasket. If covers have sound synthetic type, gaskets, retain. All granulated cork gaskets are to be replaced.

4. Check that meter is double jewel and ball or magnetic suspension. Pivot type meters will be converted to D.J.B. (Double jewel and ball).

5. Check insulation resistance between coils and meter frame or grid ensuring that good contact to the grid is obtained. Minimum permissible insulation resistance value is 5 megohms. Any reading less than this value is to be investigated and the faulty component replaced.

6. Check coils for continuity. Resistance values of voltage coils are given in attached appendix. Any variation exceeding ±10% shall be referred to a supervisor for determination. Current coil resistance values are so small that they cannot be accurately measured with the standard "ohms" scale of the "Insulation Resistance Tester". Inspection should be made to check for signs of damage or overheating, etc. With the exception of modern "M" type meters, all double wound current coils will be replaced. Any coil showing insulation damaged by heat, whether voltage or current coil must be replaced.

7. Inspect meter interior carefully for signs of dust, dirt, corrosion, overheated terminal connections or flash burns. Replace any component if damaged.

8. Remove register, and if D.J.B. meter, remove disc and bearing system. Five dial registers are to be salvaged for cleaning and reuse as are all bearing components with the exception of the ball. "Stippled" discs will also be salvaged. Unless damaged, or unsatisfactory in any way, all magneti suspension discs and bearings will be re-used without further processing. If it is necessary to remove the meter element from its case to replace base or other components, it is necessary to remove disc and bearing system befor doing so to prevent damage. This applies to all meters.

9. Inspect brake magnets (in old type meters) for signs of chalking and inspec grids and coil formers for signs of rust. Rusted components are to be rejected. Chalking magnets are to be wiped clean with a soft cloth, cleaned with air, and a very light smear of machine oil rubbed well into the magnet until no visible residue remains.

10. If it does not appear necessary at this stage to remove the meter from the case, all connections must be checked for tightness and the interior blown out with the special air gun provided.

11. Check that the property plate is S.C.C. and that it is in good condition with embossed property numbers "Other Council plates shall be removed and a replacement obtained through the supervisor or as instructed by him. A number of early meters carry plates with stencilled property numbers. The supervisor will arrange replacements for such plates. All queries regarding property plates MUST be channeled through the supervisor to prevent the duplication of numbers, etc.

12. Where it is necessary to replace meter coils, it is advisable to check the gap between the existing coils so that the new coil can be installed with a similar gap thus avoiding in many cases, the necessity for later dismantling for regapping. If two coils are to be replaced they should be removed one at a time so that the replacement coil can be fitted with the possibility of changing the gap position thus causing problems between the alignment of the brake magnet gap and the electro magnet gap so leaving the disc free to rotate without obstruction.

13. Generally speaking, replacement registers will not be fitted by apprentices working in the meter repair section unless specifically instructed to do so in individual instances. Registers will be fitted in the meter laboratory during final checking and calibration.

14. Before commencing load checking and calibration, a final visual check of the meter shall be carried out to ensure that the general appearance of the meter is satisfactory for service, i.e. meters have a "near new" appearance.

15. It should be emphasised that meters should be worked on "one at a time" to avoid interchanging of components, property plates, etc.

16. All meters are to be tested for a minimum of 20 revolutions with a unity power factor load of 20 amps (HL TEST) and a minimum of 5 revolutions with a load of 1 amp (U.P.F.). Calibration limits are between 0÷ to 0.5÷ for both loads. After calibration, the meter is to be checked for "creep" by applying only rated voltage.

17. On satisfactory completion of the foregoing, a final visual re-check of the meter is to be carried out, a clean cover fitted, a self-adhesive label affixed to the back showing the date and apprentice's name. The meter is then to be placed on the bench designated for the purpose for transfer to the Low Voltage Laboratory for final checking and testing before issue to field staff.

NOTE:

a) B.A.Z. 10/40 meters have all black voltage coils but replacement coil may be BAZ/M1 10/60 coil with white band. If any coil removed from any meter has quadrature loop fitted, this must be removed and fitted to replacement coil. M2 10/80 meter has yellow band on coil. Only similar coil may be used as replacement. No B.A.Z. 25/125 voltage coils (with white band and additional blue band) are available but replacement with white banded 10/60 coil is permissible. In this case, coil leads must be crossed over to ensure correct direction of travel of disc.

b) Calibration limits are as in (16) above for all meters.

c) St. George, Mackellar or Brisbane Water meters ex these Council will have property plates changed in Meter Laboratory during calibration.

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PROCEDURE FOR TESTING AND CALIBRATION OF SINGLE PHASE METERS. L.V.M.L.

1. Select 12 meters and carry out a visual inspection to ensure that no damage to base, terminals etc. exists. Meters should preferably be similar types and similar revs per kilowatt hour. Check that cable terminals are correct size i.e. all meters other than 10/40, and 10/60 meters with chrome steel magnets must have 3/8" terminals. Check terminal screw size - must be OBA. Check for signs of corrosion inside terminals. Check property plates are S.C.C. Irrespective of area of origin, when put back into service after testing and calibration all meters must carry S.C.C. property plates. Property plates to replace "other area" plates are held by the supervisor in L.V.M.L. and changing of such plates is to be carried out in consultation with the supervisor.

   A small number of meters with non-standard cable terminal arrangements exists (i.e. one example L & G 10/70). These meters will be tested and returned to service without modification to the terminal arrangement.

2. Remove all covers, check covers for damage, loose glass, cork or damaged gaskets. Check securing screws for signs of corrosion. NOTE: All cork gaskets must be replaced by synthetic type.

3. Carry out internal visual check for signs of corrosion, flash burns, rust on coil formers, dust and dirt. Carry out insulation resistance test. (Minimum acceptable I.R. is 10 Megohms). Check voltage coil for continuity. If above items are satisfactory check that all internal connections are tight. "Bottom" all screws in cable entry terminals to prevent loss in transit. Check tightness of all visible screws. If traces of broken glass are found inside any meter, that meter shall be rejected and returned to the meter repair section for attention.

4. Mount meters on test board and remove all registers. Disc and bearing systems will not be removed from magnetic suspension meters unless damaged or unsatisfactory. With Double Jewel and Ball suspensions all discs are to be removed and salvaged for cleaning and re-use. (BALL is not salvaged). Registers with low readings, if fitted with anodized dial plates, and which are mechanically satisfactory, may be wound back and used again.

5. Clean interior of meter using compressed air where necessary. Ensure that magnet gaps are not obstructed by dust or metallic particles. A special tool is available for this purpose, steel instruments should NOT be used to clean magnets. Special attention should be given to ensure that no dust remains around bottom terminals. Where meters are fitted with chrome steel magnets, special attention is to be given to cleaning these with a dry rag both inside and outside, followed by a slight smear of light machine oil rubbed well in so that no external traces of oil remain.

6. Where applicable i.e. double jewel and ball type meters, replace disc and bearing systems and select 60 amp U.P.F. load. Run meters and set discs to run in centre of gap by adjusting height. Ensure discs are straight and free running.

7. Select registers - or refit original registers, after ensuring each register has been designed for use with the same revolutions per kilowatt hour as shown on the meter property plate. Reset all registers to read 1.5 or 2 kWhrs behind 00000 to allow for registration recorded during testing and calibration. (Actual amount will depend upon the experience of the operator.) Carefully check meshing at no load and load settings. Satisfactory meshing requires about ½ tooth engagement. A special tool is available for adjusting the meshing.

8. Calculate Rotary figures for the various loads:
   - (a) Heavy Load - 20 meter revs at 20 Amp U.P.F. Load
   - (b) Light Load - 5 meter revs at 1 Amp U.P.F. Load
   - (c) Power Factor - 20 meter revs at 20 Amps 0.5 Lag.

9. Set load selector, power factor compensator and load compensator to the correct settings for the size and type of meters being tested.

10. Commence Heavy Load test by applying 20 amps U.P.F. for (say) 2 meter revolutions. ROUGH adjustment can be made at this stage and by increasing the number of meter revolutions progress to final adjustment using 20 meter revs. When HL. is within tolerance proceed to light load test. SEE NOTE C.

11. Carry out Light Load test by applying 1 Amp at U.P.F. for (say) 1 meter rev, carrying out ROUGH adjustment and proceeding to increase meter revs until final adjustment is carried out with 5 meter revs. When L.L. is within tolerance, carry out a re-check of H.L. as L.L. adjustments may have had an effect on H.L. If H.L. has to be adjusted then L.L. will need checking again. When both H.L. and L.L. are within tolerance, proceed to carry out power factor test. SEE NOTE C.

12. Carry out Power Factor test by applying 20 Amps at 0.5 lag for (say) 10 meter revs. Carry out any adjustments necessary, finally checking at 20 meter revolutions. If any adjustments are made, a check of H.L. and L.L. must be again carried out. Continue checking and where necessary carry out adjustments until H.L. L.L. and PF are all within tolerances. Have check test carried out by supervisor. SEE NOTE C.

13. Apply Starting Load to meters - this is 1/200 of the basic/rated current of the meters under test:

i.e. for 10 amp meters S.L. = 50 m.a. (12 watts)
" 15 amp " " = 75 m.a. (18 watts)
" 20 amp " " =100 m.a. (24 watts)
" 25 amp " " =125 m.a. (30 watts)

(ensure board is set for U.P.F. during this test).

All meters must complete one revolution and continue to rotate.

SEE NOTE A.

14. Carry out Creep test by applying rated voltage (no load). Discs may move but should be stopped within thirty minutes. SEE NOTE A.

15. Run meters, until all are exactly one kilowatt hour behind 00000. Check that all 1/10th dials are zero. Set load selector to 40 amps. Set rotary dials to zero. Have board checked, by either supervisor or another technician. Carry out 1 kWh Dial Test. As soon as test is completed have board checked again, this should ensure that procedure is correct and confirmed as correct. Ensure all dial pointers are exactly zero, adjust where necessary.

16. Fit clean covers, (both inside and outside) seal meters. Attach "TESTED" sticker across "Load" terminal (ensuring that sticker is signed and dated) after removing meters from board.

NOTES: (a) Starting Load test and Creep Test need not necessarily be carried out in the exact sequence as above. A morning tea break or lunch break could be conveniently used as a time saving measure where appropriate.

(b) Where any component is removed from a meter subsequent to the commencement of testing and calibration, or where the height of the disc or meshing of a register is changed under similar circumstances, a full recheck of all calibrations completed on that meter up to this point shall be carried out.

(c) Tolerances (as at Feb. 1983)

Heavy Load	0.5 - to 0.5%+
Light Load	0.7 - to 0.7%+
Power Factor	1.0- to 1.0+

240 VOLT A.C. METER DATA

TYPE AND RATING	REVS. PER kWh	R.P.M.	CONSTANT (K)	MAGNET AIR GAP	RETURN PLATE AIR GAP	POTENTIAL COIL RESISTANC AND MARKINGS
EMC2-20	500	40	2.0		0.160"	900 ohms ± 10%.
EMC3-10	1000	40	1.0		0.125"	410 ohms ± 10%.
EMC3-20	500	40	2.0		0.125"	410 ohms ± 10%.
AZ-Ratio	Various	16	–	0.125"	0.1875"	All 230 ohms ± 10%.
AZ-10	400	16	2.5	0.125"	0.1875"	
AZ-25	160	16	6.25	0.120"	0.1825"	
AZ-50	80	16	12.5	0.120"	0.1825"	
BAZ-Ratio	Various	16	–	0.125"	0.1875"	All BAZ before S.C.C. N 202200 are 230 ohms ± 10
BAZ-10	400	16	2.5	0.125"	0.1875"	
BAZ-25	160	16	6.25	0.120"	0.1825"	From 202201 to 295000 a 320 ohms ± 10%.
BAZ-50	80	16	12.5	0.120"	0.1825"	
BAZ-10/40	400	16	2.5	0.125"	0.1875"	From 295001 onwards are marked with white band.
BAZ-50/100	80	16	12.5	0.120"	0.1825"	
BAZ-10/60	400	16	2.5	0.125"	0.1875"	
BAZ-25/100	160	16	6.25	0.125"	0.1875"	Marked with blue band also
MI-10/60	400	16	2.5	0.125"	0.1875"	280-320 ohms.
EMT-10/40	600	24	1.66	0.125"	0.133"	870 ohms ± 5%.
WF2-10/60	250	10	4.0		0.125"	All 1350 ohms ± 5%.
WF2-20/100	125	10	8.0		0.125"	
WF2-10/60	300	12	3.33		0.120"	
WF2-20/100	150	12	6.66		0.120"	
WF3-10/60	250	10	4.0		0.125"	310 ohms ± 5%.
S.D. with screwed grids	A (Red) and C (Blue) phases				0.187"	230 ohms ± 10%.
	B (Yellow) phase				0.190"	
S.D. with rivetted grids	A (Red) and C (Blue) phases				0.180"	230 ohms ± 10%.
	B (Yellow) phase				0.190"	

Notes:
1. All BAZ 10/40 S.C.C. Nos. 104501 to 113964 to be fitted with long range series coils having O/L strips.
2. MI and WF3 have magnetic flotation bearings.